Conceptual Design Report Addendum – Reach 8

Kerr-McGee Chemical LLC
Kress Creek/West Branch DuPage River
DuPage County, IL

March 2003

BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

Conceptual Design Report
Addendum - Reach 8

Kerr-McGee Chemical LLC
Kress Creek/West Branch DuPage River
DuPage County, IL

March 2003

Respectfully submitted,

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Principal Engineer

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1. Introduction

1.1 General

This document has been prepared by Blasland, Bouck & Lee, Inc., (BBL) and Sevenson Environmental Services, Inc. (SES), on behalf of Kerr-McGee Chemical LLC (Kerr-McGee), as an addendum to the *Conceptual Design Report* (BBL, October 2002a) and *Conceptual Restoration Design Plan* (BBL, October 2002b) for the Kress Creek/West Branch DuPage River Site (Site) located in DuPage County, Illinois (Figure 1-1). Specifically, this addendum focuses on the proposed remedial approach for the removal and subsequent management of sediment materials that exceed the cleanup criterion (i.e., 7.2 picoCuries per gram [pCi/g] total radium) within Reach 8 - McDowell Lake (the “Lake”). The Lake is located within the West Branch DuPage River (the “River”) as shown in Figure 1-1.

The extent of impacted materials in McDowell Lake was identified in 2001 and 2002 as part of an overall Site investigation that included walk-over surface gamma radiation surveys and a delineation drilling program with downhole logging as guided by the *Investigation Work Plan for the Kress Creek/West Branch DuPage River Site* (Bono Consulting, July 1999). The overall Site investigation was conducted between 1997 and 2002, and is summarized in the *Characterization Report for the Kress Creek/West Branch DuPage River Site* (ProSource Technologies, October 2002).

This addendum has been prepared to supplement the *Conceptual Design Report* (BBL, October 2002a) for the Site, and as such describes only those activities specific to the investigation and proposed remediation of McDowell Lake. Activities common to the removal and management of excavated materials throughout the Site (e.g., general construction related activities, materials handling) will be performed as described in the *Conceptual Design Report* (BBL, October 2002a). These activities are described in detail in Sections 3 and 5 of the aforementioned report. As with the other Site reaches, detailed engineering design will be prepared prior to the associated construction activities within McDowell Lake.

1.2 Purpose and Report Organization

The purpose of this addendum is to present the conceptual design for removal and disposal of sediment materials within Reach 8. Section 2 provides a description of McDowell Lake including a discussion of the characteristics of the Lake and surrounding area. Section 3 discusses the remedial approach developed for the McDowell Lake area including a description of the remedial approach, an excavation plan, a description of supporting technologies, restoration, duration and cost.

2. Description of McDowell Lake

2.1 General

The information used to prepare this addendum includes various documents/drawings that summarize information previously gathered by Kerr-McGee (as described in Section 2 of the *Conceptual Design Report* [BBL, October 2002a]), and observations made by BBL personnel during Site Familiarization/Wetlands Evaluation Studies performed on September 6 and 20, 2002. As part of the studies, BBL personnel performed visual surveys of the Lake, River, and surrounding properties to gather information (e.g., habitat types, potential staging areas and haul road locations, access, constructability concerns, etc.) for use in the preparation of the conceptual design. The remedial approach for the Lake is described in Section 3.

2.2 Description of McDowell Lake

McDowell Lake is located within the West Branch DuPage River approximately 2 miles downstream of the Warrenville Dam (downstream boundary of Reach 7). For consistency with the *Conceptual Design Report* (BBL, October 2002a), McDowell Lake is designated as Reach 8. Reach 8 is approximately 1,600 feet long and extends along the West Branch DuPage River from approximately 3,400 feet south of Diehl Road to McDowell Road. McDowell Road provides the only vehicular access to the park and parking lot area which run parallel with the River to the south of the reach. The bridge over the West Branch DuPage River at McDowell Road is restricted to single lane traffic.

The Lake is encompassed by the McDowell Grove Forest Preserve and the land surrounding the reach contains numerous biking and hiking trails and several fire roads. Ferry Creek flows into the Lake from the north. Removal from this reach will be solely sediment materials and water depths are fairly shallow, ranging from 1 to 3 feet over much of the Lake, to near 10 feet in the thalweg channel along the southern near shore area of the Lake.

3. Description of Remedial Approach for McDowell Lake - Reach 8

3.1 General

The following provides a specific discussion of the proposed removal methods to be employed for Reach 8, including a description of the removal activities, an excavation plan, a description of supporting technologies, anticipated duration, and preliminary cost. The approximate locations of the various components of the removal approach are provided on Figure 3-1. The overall preliminary construction schedule for the entire Site is presented on Figure 3-2.

The remedial approach described herein was developed based on consideration of site-specific knowledge, related experience at other Sites, and the results of an assessment of the potential for increased upstream flooding during remediation activity, as described in Appendix A. Appendix A presents a preliminary assessment of flooding and scour potential based on water surface elevations and flow velocities predicted through hydraulic modeling of the West Branch DuPage River. Assessment of flooding potential during remediation of the other reaches (Reaches 1 through 7) was based on hydraulic simulation of water diversion structures during remediation as presented in the *Conceptual Design Report* (BBL, October 2002a). For Reach 8, River cross-section data in an existing hydraulic model of the West Branch DuPage River provided by DuPage County was supplemented with additional cross section data collected by Kerr-McGee in October 2002. These data were used to develop a steady-state hydraulic model for Reach 8 that was used to predict water surface elevations and flow velocities for a 2-year return flow. The hydraulic modeling approach is described in detail in Appendix A.

It should be noted that components of this conceptual remedial approach will be refined during the detailed design phase with appropriate pre-design investigations performed to further understand Site conditions (e.g., geotechnical conditions to address potential issues with sheetpile installation, groundwater infiltration) and process option performance (e.g., construction water filtering, dewatering).

3.2 Development of Remedial Approach for McDowell Lake – Reach 8

The remedial approach developed for each reach was based on information provided by Kerr-McGee regarding Site characteristics, observations made during the Site Familiarization/Wetlands Evaluation Studies, and in consideration of additional criteria outlined in the *Conceptual Design Report* (BBL, October 2002a) such as technical feasibility/constructability, safety, material handling/staging, etc. Reach 8 involves removal activities that are very similar to those expected in Reach 7, with common elements such as nearly all of the material to be removed being sediment, a large body of water to work in, and a relatively large volume of material to be removed. In developing the remedial approach for Reach 8, the same set of alternatives that were fully developed for Reach 7 and the advantages and disadvantages of each were taken into consideration.

For the same reasons as were identified for Reach 7 (BBL, October 2000a), complete bypass pumping around Reach 8 was not deemed to be the best approach due to the large flow volume in the system and the presence of the Ferry Creek tributary to McDowell Lake. The flow volume was a critical issue when evaluating this option for Reach 7, and since Reach 8 is an additional 2 miles downstream of Reach 7, and receives additional tributary flow, flow volumes are expected to be even larger. As discussed in Appendix A, flow from Ferry Creek during the 2-year design flood approaches 600 cubic feet per second (cfs), a flow rate that would likely be technically impracticable to pump bypass. In a similar manner, hydraulic dredging of Reach 8 was also considered, but eliminated due to the imprecision of excavation, resuspension and loss of materials from the dredgehead, and lack of ability to control post-remediation surface concentration issues that were identified in the analysis of Reach 7 alternatives.

Given these considerations, the proposed remedial approach developed for Reach 8 is excavation performed through the use of dewatering, using sheetpile to divert flow. Based on analyses performed in Reaches 1 through 7, it is anticipated that groundwater infiltration into the remedial areas can be addressed through the use of a sump system, and the lack of overlying water will allow for the greatest possible precision when excavating materials. This remedial approach is described in detail below and the approximate locations of the various components of the removal approach are provided on Figure 3-1.

As stated above in Section 1, common construction-related activities including removal and disposal of vegetation, provisions for Site controls and access, obtaining appropriate permits and approvals, identification and protection of utilities, implementation of erosion and sedimentation controls, survey and Site layout, establishment of health and safety protocols, environmental monitoring, verification of removal limits, material handling/screening/processing, staging area construction, dewatering process, and handling of water are described in detail in the *Conceptual Design Report* (BBL, October 2002a).

3.3 Calculation of Volume for McDowell Lake – Reach 8

Using a calculation approach consistent with that outlined in the *Conceptual Design Report* (BBL, October 2002a), the total volume of material targeted for removal from Reach 8 is estimated to be approximately 24,700 cubic yards (cy). This volume consists solely of sediment materials that either test above or below the cleanup criterion from Reach 8 (for completeness, the specific volume breakdown for Reaches 1 through 8 is provided on Table 3-1).

3.4 Description of Remedial Alternative for McDowell Lake – Reach 8

Excavation of materials in Reach 8 will be performed through the use of dewatering and steel sheetpile to divert River flow. Sheetpile will be configured and installed so as to accommodate the hydraulics of the Lake. Note that although it is not possible to eliminate water in the excavation area, use of sheetpile or similar techniques is expected to make the excavation manageable.

Excavation is anticipated to occur in three stages. These stages are illustrated on Figure A-4 in Appendix A to this addendum. Initially, the smaller upstream removal area just north of the island in the River will be excavated. Sheetpile will be placed at the upstream and downstream ends of the northern channel to divert flow. Once the smaller removal area has been excavated, the sheetpile will be relocated to allow for removal in the larger downstream removal area west of the island. Sheetpile will be installed, from barge-mounted and shore-based equipment, to segment the larger removal area into two sections. Excavation will be performed in the southern and eastern portions of the larger area first. To accomplish this, sheetpile will be installed from the southern shore to the northwest corner of the island and across the inlet to the southern channel at the east end of the island to divert water from the West Branch DuPage River and from Ferry Creek. Once excavation is completed in the southern and eastern portion of the larger removal area, the northern portion of the larger removal area will be addressed. To perform removal in this area, sheetpile will be reconfigured to divert water into the northern and southern channels. Performing excavation activities in this manner will provide sufficient hydraulic capacity to allow passage of combined West Branch DuPage River and Ferry Creek flows while minimizing increases to both water surface elevation and scour potential.

Hydraulic modeling predictions of flood stage surface water elevations indicate that for remediation of the area downstream of the island, increased flooding potential will likely be negligible. For remediation of the south channel of the island, which requires directing flow through shallower areas of McDowell Lake, there is some potential for increased scour of overburden sediments, although it is expected to be fairly small and could be mitigated by placement of stone armor in the River bottom and on the banks in critical areas (e.g. inlet to the northern channel). The stone armor could also potentially serve as a stream bed enhancement if left in place as part of restoration. Further information on modeling efforts is provided in Appendix A, and will be refined during detailed design. The extent and method of scour protection will also be further evaluated during detailed design.

Within each removal area, for initial dewatering activities, a series of pumps will be installed to pump the water from the targeted excavation side in preparation for removal activities and to keep the area dewatered during excavation operations. These pumps will discharge water downstream of the bridge at McDowell Road. Appropriate engineering controls will be implemented to dissipate energy associated with these discharges.

In addition to the pumps, additional sumps will be set up as needed to assist in dewatering the removal areas with the water transferred to the main dewatering sump. The sumps will be used to keep the area dewatered during excavation operations. Water collected with the sumps will be pumped to the temporary sedimentation and erosion control area for filtering prior to the discharge point downstream of the bridge at McDowell Road.

Two soil staging areas will be constructed in this reach. One staging area will be constructed within the McDowell Grove Forest Preserve north of McDowell Lake as shown on Figure 3-1. The access road for the northern staging area will allow Raymond Road to be used by construction vehicles. The second staging area will be placed along the southern shore at the downstream portion of the reach as illustrated on Figure 3-1. Depending on the need or ability to maintain access to the area by the general public during construction, it may be possible to locate this staging area on the existing parking lot areas. Access to this staging area will be achieved through the use of McDowell Road. It is anticipated that a temporary bridge will need to be constructed at McDowell Road as the existing bridge at the location is restricted to one lane of traffic and would not be capable of supporting construction vehicles. The staging areas and access roads will be constructed as described in the *Conceptual Design Report* (BBL, October 2002a).

3.5 Excavation Plan for McDowell Lake – Reach 8

As described above, each portion of the reach will be excavated in a sequential manner through the use of sheetpile walls for water diversion. Once the water has been diverted, a dewatering sump system will be installed as necessary within the portion being excavated to keep the area dewatered during excavation operations. The sump system will be used to keep the area dewatered during excavation operations by pumping accumulated water to the temporary sedimentation and erosion control area for filtering. A silt curtain will be installed at the downstream end of the reach to mitigate migration of suspended solids.

Once the sumps have been installed in the area targeted for removal, haul roads will be constructed along either the northern or southern shore depending on the location of excavation activities. In addition, finger roads will be constructed as necessary within each segmented removal area to provide for access to the complete removal area. The approximate location of the haul roads is provided on Figure 3-1, and road construction will be performed as described in the *Conceptual Design Report* (BBL, October 2002a).

Excavation of the targeted areas will begin at the upstream end of the targeted area and continue downstream using excavators and an adequate number of off-road haul trucks to allow for continuous removal activities. Within each removal area, removal of the overburden material will be performed first. All excavated overburden will be transported to the nearest staging area (i.e., material from northern reach will be hauled to the staging area located to the north, whereas the material removed from the southern side will be hauled to the southern staging area) where it will be allowed to gravity dewater and staged for radiological screening as described in the *Conceptual Design Report* (BBL, October 2002a). If such materials are confirmed to be below the cleanup criterion, the material will be removed from the pad for provision to the Forest Preserve District for their use. If the material does not satisfy the cleanup criterion, it will be transferred to the side of the staging area containing materials that exceed the cleanup criterion in preparation for loading to the transfer station for off-site disposal. The overburden excavation operations will continue downstream until all overburden has been removed.

In a similar manner, excavation of other material will begin at the upstream end of each removal area and continue downstream until completion. This material will be hauled to either the northern or southern staging area (depending on which portion of the reach is being excavated) where it will be allowed to gravity dewater and stabilized using quicklime (approximately 15% by weight), as necessary, in order to meet paint filter and moisture content requirements for disposal. Materials above the cleanup criterion will be loaded and transported to the transfer station for disposal. It is estimated that all sediment materials will be excavated at a rate of 400 cubic yards per day (cy/day).

After all removal and restoration activities have been completed in the reach, access and haul roads and staging areas will be excavated. As appropriate, stone will be salvaged for reuse. All remaining materials will be radiologically screened prior to transport to the disposal transfer station. Similarly, once restoration operations in the River are complete, all water diversion materials will be removed and salvaged or disposed as appropriate.

3.6 Supporting Technologies for McDowell Lake – Reach 8

As previously described, a series of sumps will be installed to allow for manageable excavation within the targeted removal areas. Water collected from the sumps will be transferred to a main dewatering sump and pumped to the temporary sedimentation and erosion control area for filtering prior to discharge downstream of the bridge at McDowell Road. Also, water collected at the staging areas will be transported for filtering prior to discharge downstream of McDowell Road. Additional detail regarding these supporting technologies and materials handling techniques are discussed in the *Conceptual Design Report* (BBL, October 2002a).

3.7 Restoration – Reach 8

All disturbed floodplain areas (including the staging area, haul/access roads, temporary sedimentation and erosion control area for filtering) will be backfilled to finished grades with a planting soil and appropriately revegetated in accordance with the *Conceptual Restoration Design Plan* (BBL, October 2002b). If the parking lot area south of McDowell Lake is used as a staging area, its surface will be restored to pre-construction conditions. The removal of sediments from McDowell Lake will not result in a disturbance to the Lake that will require the restoration of existing bottom elevations. The removal of fine material that has accumulated on the

Lake bottom has been acknowledged as an improvement to the River system. Therefore, removed material will not be replaced in the Lake bottom.

A preliminary evaluation of habitats and environments surrounding the Lake identified upland deciduous forest and emergent/scrub-shrub wetlands as the dominant land uses. The forest uplands exhibited a variety of tree sizes and degrees of canopy closure, and non-native tree species (e.g., buckthorn) were observed in these areas. Emergent wetlands were observed along the Ferry Creek corridor. DuPage County Wetland Inventory mapping indicates wetland areas along the margins of the West Branch DuPage River and McDowell Lake (Figure 3-3). The extent of wetlands indicated on the County map was not observed during the Site Familiarization/Wetlands Evaluation Study. A more detailed evaluation/delineation will be performed as part of future detailed design efforts. However, the extent of wetlands depicted on the County map was utilized at this conceptual stage to estimate restoration requirements.

Although the areas surrounding the Lake will not be directly impacted by sediment removal from the Lake, access roads and staging areas are required in these areas to access and remove the material. Access roads and staging areas were sited to avoid and/or minimize disturbances to sensitive environments, such as wetlands, and were placed in upland forest areas with trees of relatively small diameters, when possible. However, the need to locate access roads along the Lake margin limited the ability to avoid wetlands indicated on the County map in this area (Figure 3-3). Once the access roads are removed, disturbed wetlands will be restored in accordance with the wetland-specific restoration procedures presented in Section 6 of the *Conceptual Restoration Design Plan* (BBL, October 2002b) for emergent and scrub-shrub wetlands. Wetland grades will be restored and the existing wetland plant communities will be re-established by a combination of seeding and planting. Precise location of access roads to potentially avoid some of these impacts can be refined during final design.

Upland areas disturbed by access roads and staging areas will also be restored. The restoration of disturbed upland forests may enhance the ecological value of the forest by eliminating non-native species, and supporting the long-term establishment of a native forest community. Upland forest communities will be restored in accordance with restoration details provided in the *Conceptual Restoration Design Plan* (BBL, October 2002b) for upland forests on the DuPage County Forest Preserve Property.

Remediation of Reach 8 will generate approximately 14,700 cy of sediment not exceeding the cleanup criterion. This material will be placed in areas nearby on site as agreed by Kerr-McGee and the Forest Preserve District. One potential use may include placing the material in berms above the limits of the 100-year floodplain. The berms would then be revegetated to provide a natural appearance.

3.8 Implementation Schedule – Reach 8

The total time to setup, perform the excavation, and restore the area is approximately 24 weeks, weather dependent.

3.9 Preliminary Cost Estimate – Reach 8

The preliminary estimated cost for this remedial approach is $10.2 million. Implementation of this alternative is expected to generate approximately 15,500 tons of material for disposal (including removed materials, finger roads, staging area materials, etc.). This includes the 10,000 cy of material exceeding the cleanup criterion stabilized using 15% by weight quicklime (a total of ~ 14,100 tons), as well as approximately 1,400 tons of stone. For completeness, a summary of the preliminary costs for Reaches 1 through 8 is provided in Table 3-2.

4. References

Blasland, Bouck & Lee, Inc. (BBL). October 2002a. *Conceptual Design Report: Kress Creek/West Branch DuPage River Site.*

BBL. October 2002b. *Conceptual Restoration Design Plan: Kress Creek/West Branch DuPage River Site.*

Bono Consulting. July 1999. *Investigation Work Plan for the Kress Creek/West Branch DuPage River Site.*

ProSource Technologies, Inc. October 2002. *Characterization Report for the Kress Creek/West Branch DuPage River Site.*

Tables

Table 3-1

Summary of Reach-Specific Material Removal Volume Estimates

Conceptual Design Report Addendum
Kerr-McGee Chemical LLC
Kress Creek/West Branch DuPage River Site
DuPage County, Illinois

Reach	Estimated Volume (cy)						
	Sediment Materials		Floodplain Materials		Total		
	Exceeding the Cleanup Criterion	Below the Cleanup Criterion	Exceeding the Cleanup Criterion	Below the Cleanup Criterion	Exceeding the Cleanup Criterion	Below the Cleanup Criterion	Total Rounded Removal
1 -- Outfall to May Street	1,655	455	4,990	1,365	6,645	1,815	8,450
2 -- May Street to Joy Road	3,915	985	3,630	910	7,540	1,890	9,430
3 -- Joy Road to Route 59	665	115	6,235	1,080	6,895	1,195	8,080
4 -- Route 59 to Confluence	105	15	3,180	355	3,285	370	3,650
5 -- STP to Williams Road	1,175	730	13,125	8,155	14,300	8,885	23,180
6 -- Williams Road to Butterfield Road	735	895	1,295	1,580	2,030	2,475	4,500
7 -- Butterfield Road to Warrenville Dam	24,545	15,475	1,295	815	25,835	16,290	42,120
8 -- McDowell Lake	10,045	14,655	0	0	10,045	14,655	24,700
Total:	42,840	33,325	33,750	14,260	76,575	47,575	124,110

Notes:

1. Total surface areas were calculated by summing surface areas (obtained from ArcView) for all individual polygons within a specified reach. Volumes were calculated using the average depth of either material exceeding the cleanup criterion (i.e., 7.2 pCi/g) or material below the cleanup criterion provided for all boreholes within each polygon and multiplying by the total surface area for each polygon.
2. Volumes were further separated by sediment or floodplain based on the percent of total surface area for each reach that exists within or outside of the Creek/River boundary.
3. The extent of removal polygons is illustrated on Figure 1-1.
4. Volumes do not account for any vertical overexcavation of material.

Table 3-2

Summary of Selected Alternatives by Reach

Conceptual Design Report Addendum
Kerr-McGee Chemical LLC
Kress Creek/West Branch DuPage River Site
DuPage County, Illinois

Alternative	Duration (weeks)	Preliminary Estimated Cost (in millions)	Total Processed Soil and Sediment Tons	Tons of Stone for T&D	Rounded Total Tons For Disposal
Reach 1 - Excavation performed through the use of dewatering, including sheetpile near the railroad/outfall area and pump bypass	12.5	$7.0	9,320	838	10,200
Reach 2 - Excavation performed through the use of dewatering, including sheetpile around the northwest lake area and pump bypass	13.5	$7.0	10,711	189	10,900
Reach 3 - Excavation performed through the use of dewatering, including use of berms and pump bypass	8	$5.9	9,621	1,484	11,100
Reach 4 - Excavation performed through the use of dewatering, with berms at Route 59/ confluence and pump bypass	5	$2.8	4,570	706	5,300
Reach 5 - Excavation performed through the use of dewatering, including use of sheetpile and pump bypass (stretch from STP to Gary's Mill Road will be excavated using turbidity barriers)	28.5	$17.7	21,295	1,126	22,400
Reach 6 - Excavation performed through the use of dewatering, with sheetpile around each removal area (except sand bags for water diversion around smaller west shore and upstream areas)	12	$4.7	2,862	1,719	4,600
Reach 7 - Excavation performed through the use of dewatering, including sheetpile to divert flow	33	$18.2	37,383	1,632	39,000
Reach 8 - Excavation performed through the use of dewatering, including sheetpile to divert flow	24	$10.2	14,063	1,390	15,500
Total:	**136.5**	**$73.5**	**109,825**	**9,084**	**119,000**

Notes:
1. Preliminary cost estimates include: engineering and design estimated at 5% of construction and restoration plus predesign investigation costs at $75,000 per reach; monitoring cost estimated at $7,500 per week; and a 20% contingency.

Figures

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REACHES

1 = OUTFALL - MAY STREET (KRESS CREEK)
2 = MAY STREET - JOY ROAD (KRESS CREEK)
3 = JOY ROAD - ROUTE 59 (KRESS CREEK)
4 = ROUTE 59 - CONFLUENCE (KRESS CREEK)
5 = STP - WILLIAMS ROAD (WEST BRANCH DuPAGE RIVER)
6 = WILLIAMS ROAD - BUTTERFIELD ROAD (WEST BRANCH DuPAGE RIVER)
7 = BUTTERFIELD ROAD - WARRENVILLE DAM (WEST BRANCH DuPAGE RIVER)
8 = McDOWELL LAKE (WEST BRANCH DuPAGE RIVER)

AREA TYPE

REMOVAL AREAS

1000 0 1000 Feet

GRAPHIC SCALE

Map Source: Map Index Provided by Kerr-McGee Chemical LLC

11-05-02

Q:\KMGee\ReachB\apr\Reach8.apr: Site Location Map Addendum

N

KERR-McGEE CHEMICAL LLC
KRESS CREEK / WEST BRANCH DuPAGE RIVER
DuPAGE COUNTY, IL

CONCEPTUAL DESIGN REPORT ADDENDUM

SITE LOCATION MAP

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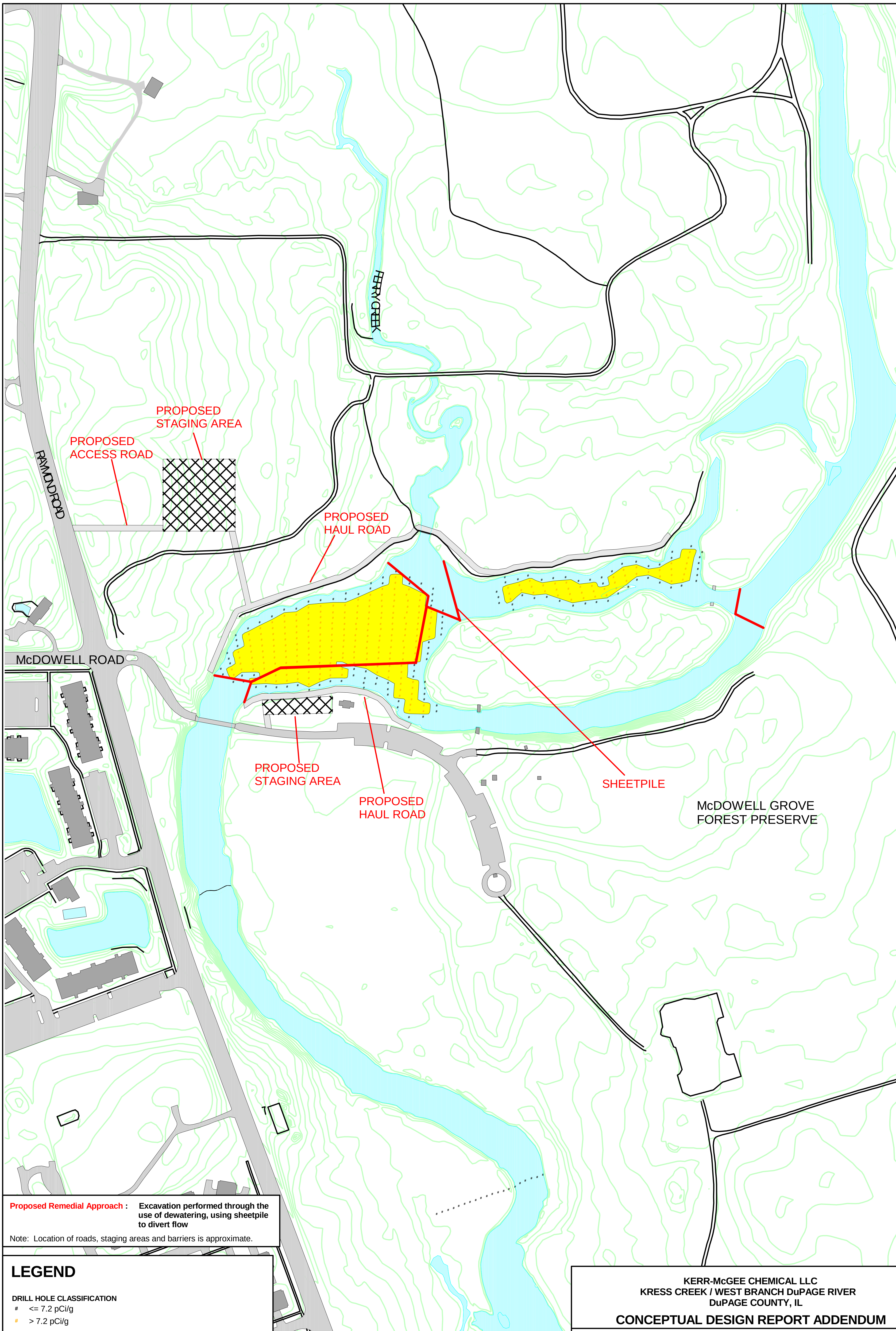
FIGURE

1-1



Proposed Remedial Approach : **Excavation performed through the use of dewatering, using sheetpile to divert flow**

Note: Location of roads, staging areas and barriers is approximate.

LEGEND

DRILL HOLE CLASSIFICATION

- # <= 7.2 pCi/g
- # > 7.2 pCi/g

AREA TYPE

REMOVAL AREAS

BARRIER TYPE

SHEETPILE

250 0 250 Feet

GRAPHIC SCALE

N

Provided by: KERR-McGEE CHEMICAL LLC

03/04/03 SYR-85 -EIB
Q:\KMGee\Reach8\APR\Reach8.apr: Figure 3-1

KERR-McGEE CHEMICAL LLC
KRESS CREEK / WEST BRANCH DuPAGE RIVER
DuPAGE COUNTY, IL

CONCEPTUAL DESIGN REPORT ADDENDUM

REACH 8 - McDowell Lake
(WEST BRANCH DuPAGE RIVER)

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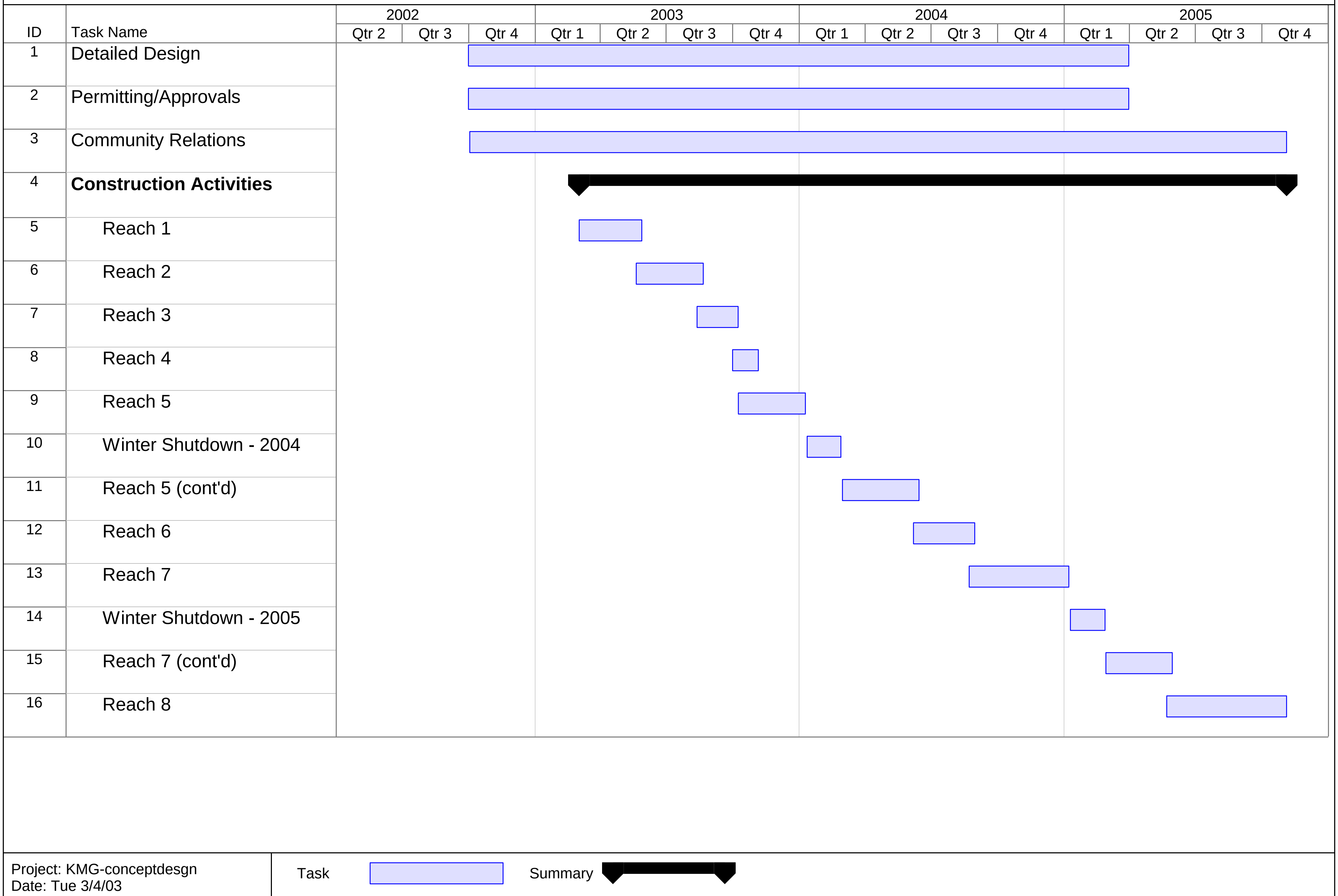
FIGURE
3-1

Figure 3-2 Preliminary Schedule



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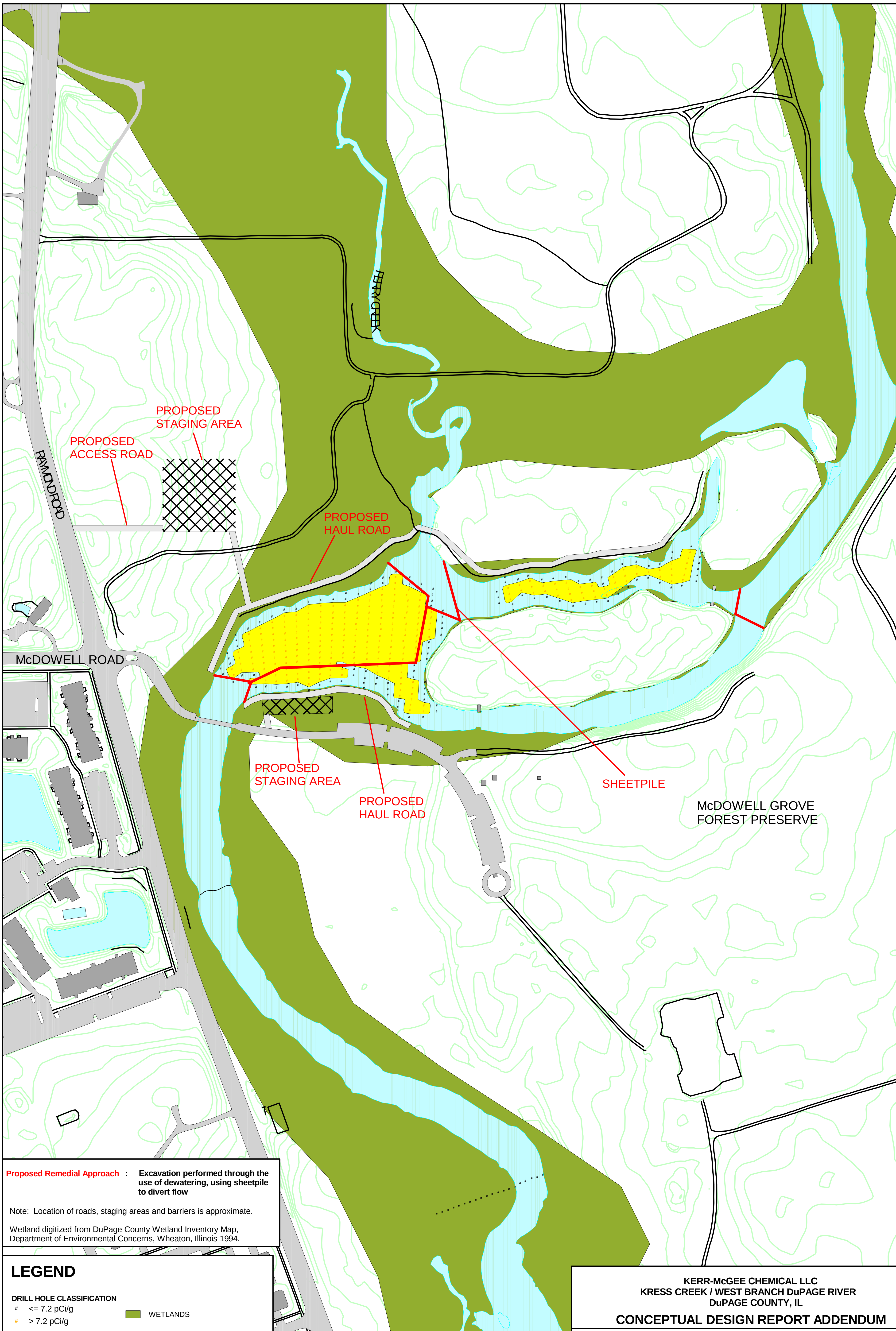

Proposed Remedial Approach : **Excavation performed through the use of dewatering, using sheetpile to divert flow**

Note: Location of roads, staging areas and barriers is approximate.

Wetland digitized from DuPage County Wetland Inventory Map, Department of Environmental Concerns, Wheaton, Illinois 1994.

LEGEND

DRILL HOLE CLASSIFICATION
- # <= 7.2 pCi/g
- # > 7.2 pCi/g

WETLANDS

AREA TYPE
REMOVAL AREAS

BARRIER TYPE
SHEETPILE

250 0 250 Feet

GRAPHIC SCALE

N

Provided by: KERR-McGEE CHEMICAL LLC

03/04/03 SYR-85 -EIB
Q:\KMGee\Reach8\APR\Reach8.apr: Figure 3-3

KERR-McGEE CHEMICAL LLC
KRESS CREEK / WEST BRANCH DuPAGE RIVER
DuPAGE COUNTY, IL

CONCEPTUAL DESIGN REPORT ADDENDUM

REACH 8 - McDowell Lake
(WEST BRANCH DuPAGE RIVER)
Extent of Wetlands

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FIGURE
3-3

Appendix A

Preliminary Assessment of Increasing Flooding and Scour Potential During Reach 8 Remediation

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Appendix A – Preliminary Assessment of Increased Flooding and Scour Potential During Reach 8 Remediation

1.0 Introduction

Conceptual design of remediation approaches for sections of Kress Creek and the West Branch DuPage River (the "River"), designated Reaches 1 through 7, included use of river hydraulic models to assess the likelihood of increased flood water surface elevations during remediation (*Conceptual Design Report* [BBL, October 2002]). Remediation of these reaches will involve pump bypassing of Kress Creek and West Branch DuPage River flows around certain remediation areas, and for other areas on the West Branch DuPage River, temporary water diversion to the opposite side of the channel from areas being remediated. Water diversion would involve placement of sheetpile walls and/or sandbag berms around the remediation areas and pump dewatering of these areas. Pump bypassing around certain areas of Kress Creek and the West Branch DuPage River would be accomplished by placement of sheetpile or sandbags across the creek to form pump pools from which water would be pumped to a discharge point downstream.

The hydraulic modeling conducted to assess flooding potential in Reaches 1 through 7 simulated sheetpile or sandbag placement, to a height of about 6 inches above the 2-year flood elevation. The 2-year flood elevation typically corresponds to the top of bank elevation on many river systems. Larger floods overtop the banks and inundate floodplains. Larger flows are intended to overtop the low sheetpile and sandbag placements as well, in order to limit increased flooding potential upstream. Thus, for flows less than the 2-year flood flow, remediation areas would remain free of overlying water. At larger flows, with flood levels rising above the sheetpile and sandbag placements, remediation areas would be flooded. Modeling results indicate that this approach (i.e., using diversion structures designed to control flows equal to or less than the 2-year flood flows) would yield negligible increases in flooding potential at larger flows for the remediation approaches identified for Reaches 1 through 7 (BBL, October 2002).

This approach was used in the analysis of flooding potential due to placement of water diversion structures for remediation of Reach 8 (McDowell Lake). Top elevations of sheetpile diversion wall structures were limited to 6 inches above the 2-year flood water surface elevation and increased flooding potential was evaluated through modeling of the 2-year flood flow. In addition, increases in flow velocities due to sheetpile placement were also assessed using model results for the 2-year event to evaluate bed scour potential during remediation activities.

2.0 Modeling Approach for Reach 8

Hydraulic modeling of the proposed remediation approach in Reach 8 was conducted using an approach similar to that used for Reaches 1 through 7. BBL obtained the Full Equations Model (FEQ) of Kress Creek and the West Branch DuPage River from DuPage County[1] (County) which was used in combination with a model developed by the United States Army Corps of Engineers (USACE) Hydraulic Engineering Center called the River Analysis System (HEC-RAS) model to assess increased flooding potential during remediation of Reaches 1 through 7. River cross sections, bridge dimensions, and hydraulic model parameters were taken from the FEQ model to develop the HEC-RAS model for these reaches. HEC-RAS was used instead of FEQ to simulate effects of remediation because of the ease of changing inputs to represent placement of water diversion structures.

In the portion of the River upstream of McDowell Dam and bounding the Reach 8 remediation area, the FEQ inputs were not as well-developed as in Reaches 1 through 7, requiring additional surveys to represent River channel and floodplain cross-sectional elevations at key points that influence flood water levels during the three remedial stages for Reach 8, particularly at the upstream and downstream end of the north and south channels around the island in this area. This additional survey data was collected by Kerr-McGee in October 2002. The existing cross-sections in the FEQ model were a combination of surveyed elevations and estimated elevations, some of which were manually-adjusted by the County during model calibration. Locations and description of the cross-sections provided with the FEQ model input files and those surveyed in October 2002 to support modeling of Reach 8 remediation are shown in Figure A-1.

The FEQ input files received from the County contained comments indicating that: 1) the actual surveyed cross-section elevations used in the model were subsequently hand-adjusted by nearly 1 foot, without supporting explanation; 2) additional transects were needed in the McDowell Dam and island area to increase model accuracy; and 3) the model would not run for certain conditions related to the Ferry Creek tributary, which were not explained. Due to these factors, a modeling analysis of remediation conditions was conducted using a hydraulic model of the Reach 8 area constructed in HEC-RAS. The HEC-RAS model representation of the

[1] Transmittal via FedEx by Christine Klepp, DuPage County Department of Environmental Concerns to Mike Erickson, BBL March 7, 2002.

Reach 8 area, using the surveyed cross-sections shown in Figure A-1 and cross-sections interpolated from surveyed locations, is shown on Figure A-2. Manning's roughness coefficients used in the FEQ model were used to specify channel and floodplain roughness in the HEC-RAS model. As in the modeling analysis of Reaches 1 through 7, FEQ-predicted water surface elevations for the 1996 flood event (one of the largest on record) were used to specify the water surface elevation boundary condition at the downstream end of the Reach 8 model. Furthermore, the HEC-RAS water surface elevation results were compared to the FEQ results as a reasonableness check for a range of steady-state low to moderate flow conditions. For comparisons between the FEQ and HEC-RAS model predictions, results were reasonable and at low to moderate flows water surface elevations were generally within a tenth of a foot.

The 2-year flood flow was used to simulate flooding potential during Reach 8 remediation. The 2-year flow magnitude was estimated based on the estimated 2-year return flow at Warrenville Dam of 1,090 cubic feet per second (cfs) (BBL, October 2002). This would correspond to a flow of approximately 1,100 cfs at the upstream boundary of Reach 8. The hydrograph developed using the FEQ model for the 1996 flood event (Figure A-3) was then used to estimate the 2-year flood flows for Ferry Creek in Reach 8. The corresponding 2-year flow in Ferry Creek was 600 cfs. This flow was used in conjunction with the upstream flow of 1,100 cfs to approximate a 2-year peak flow condition in Reach 8 for a total flow at McDowell Dam of about 1,700 cfs.

At this flow, the FEQ model indicates that approximately 60 to 70% of the River flow passes through the southern channel of the island in McDowell Lake and the remainder is conveyed through the northern channel. In HEC-RAS, 68% of the flow was apportioned to the southern channel. The HEC-RAS model results show that the 2-year flow closely approximates the bank-full flow for both the northern and southern channels around the island.

2.1 Reach 8 Remediation Sequence and Water Routing

The proposed remediation plan for the Reach 8 area uses a 3-phase approach in which three sequential water routing plans are used to divert water from three different areas for remediation. The sheetpile placement for each phase is shown in Figure A-4, panels A, B, and C. In stage 1, a sheetpile wall would be installed across the upstream and downstream ends of the northern channel around the island (Figure A-4, Panel A). In the second stage, a sheetpile wall section will be placed from the northwest corner of the island and extended west and south downstream of the island, as shown in Figure A-4, Panel B. The sheetpile walls at the upstream and downstream ends of the northern channel will be removed and a sheetpile wall will be installed across the upstream end of the southern channel. This will route the flow of the West Branch DuPage River through the northern channel to McDowell Lake. Ferry Creek would continue to flow to McDowell Lake but the southern channel and the southern portion of McDowell Lake will be isolated and dewatered to allow for excavation of sediments. In the third stage, a portion of the sheetpile wall used in Stage 2 west of the island will be retained; however, the ends of this section would be connected to the north bank. The sheetpile wall at the upstream end of the southern channel will be removed. In this manner, the West Branch DuPage River will be allowed to flow through both the northern and southern channels. Flow from Ferry Creek will be allowed to flow downstream west of the island (Figure A-4, Panel C).

3.0 Model Results

To simulate flooding effects due to flow diversion for Reach 8 remediation, the HEC-RAS model was configured to represent each of the flow routing schemes for remediation Stages 1 through 3 shown in Figure A-4, Panels A, B, and C. Changes in water surface elevations for the 2-year flood event were assessed by comparing predicted water surface elevations for the existing system (pre-remediation) to the results for each of the three stages. Flow velocities during Stages 2 and 3 in the northern and southern channels were output from the model and compared to those computed for existing conditions for the 2-year event. The model-computed water surface elevations and velocities for the 2-year event for the existing system are referred to as the "base case."

Changes in water velocities were computed from the base case to assess changes in bed scour potential. In addition, for Stage 2, bottom shear stresses were computed based on predicted velocities, mean channel depths, and typical bottom roughness coefficients to provide an indication of sediment scour potential, with the objective of selecting a flow diversion approach that would yield minimal increases in bed scour during high flow events.

3.1 Base Case

The 2-year flow event water surface elevations and flow velocity results computed by the HEC-RAS model provide the base case to which results for the Stage 1 through 3 remediation scenarios are compared. Base case results for the 2-year event show a fairly constant, low water surface slope through McDowell Lake. Base case velocities for the 2-year event vary from about 1 foot per second in McDowell Lake to a maximum of about 2 feet per second (ft/sec) at the head of the southern channel. At the head of the northern channel maximum velocities are about 1.5 ft/sec for this event.

In the southern channel, velocities generally increase as depths become shallower moving out of the McDowell Dam backwater. The 2-year flow velocities increase moving upstream in the southern channel from about 1.5 ft/sec to 2 ft/sec. Results show that flow velocities at the head of the northern channel are generally about twice as high as in the rest of the channel due to the narrow channel opening. Water depths are deeper at this location as a result, and it is likely that the upstream portion of the channel experiences alternating sediment deposition and scour in response to high flow events.

3.2 Stage 1

For simulating flow routing during Stage 1, the entire flow in the River was directed through the southern channel, assuming sheetpile walls would be placed across the upstream and downstream end of the northern channel as shown in Figure A-4 Panel A. Results show that for the 2-year flood flow, velocities would increase about 1 ft/sec in the southern channel and water surface elevations would increase up to approximately 5 inches at the upstream end of the southern channel and some distance upstream (Figure A-5). At the downstream end of the channel, where it widens into McDowell Lake, the water surface elevation would essentially be unchanged. This simulation assumed that sheetpile placed across the northern channel entrance would be of sufficient height to exclude the 2-year flow and thus would be placed at an elevation approximately 6 inches above the predicted 2-year flood water surface elevation.

Effects on water surface elevations upstream of the island diminish with distance, and are likely negligible within one half mile of the island, such as at the Diehl Road Bridge, based on the River slope in this reach. Increased flooding potential in the upstream area will be modeled in final design analysis.

Model results for the Stage 1 simulation show that flow velocities for the 2-year event will be about 1 ft/sec higher than the base case velocities in the southern channel.

3.3 Stage 2

For Stage 2, the model configuration was changed so the flow from the West Branch DuPage River upstream of the island was routed through the northern channel as shown in Figure A-4 Panel B. Additionally, the River cross-sections in McDowell Lake between the island and the McDowell Road Bridge were modified by simulation of levees at the location of the sheetpile walls that will be placed to dewater the southern portion of the McDowell Lake that will be remediated in Stage 2. This confines River flow to between the sheetpile wall and the north bank. An example of the modified cross-section representing this (located downstream of Ferry Creek) is shown in Figure A-6. Sheetpile elevations placed during remediation in upstream reaches will be determined based on the 2-year flood elevation. The top of the sheetpile will be limited to about 6 inches above the predicted 2-year flood flow water surface and at larger flows, the sheetpile would be overtopped and the remediation area inundated. This would allow both the north and south channels to accommodate flow during large events.

Results in the northern channel show that water surface elevations would be about 0.5 feet above the base case near Ferry Creek and about 1.3 feet higher than the base case at the head of the island (Figure A-7). The elevated flood levels in the northern channel are due to two factors: restriction of the channel downstream due to sheetpile placement; and diversion of the southern channel through the northern channel.

Computed flow velocities at the entrance to the northern channel increase from 1.5 ft/sec to over 3.5 ft/sec. In the northern channel, model results show that flow velocities increased from 1 foot per second to between 2 and 2.5 ft/sec. Increased scour potential in the northern channel may be negligible considering that it will have been deepened through remediation in Stage 1.

In the vicinity of the sheetpile location, the velocities increase from 1.7 ft/sec to 2.8 ft/sec. This increase is attributed to the constriction of flow through the shallow portion of McDowell Lake due to sheetpile placement. An increase in velocity can increase the scour potential. To assess the potential impact the increase in channel velocities would have on the remobilization of sediments in McDowell Lake, an estimate of sediment scour depths was made for the sediments in McDowell Lake during the Stage 2 remediation. The physical properties for the sediments in McDowell Lake have not been collected. To estimate the depth of scour, the bed shear stress during the 2-year flood event in McDowell Lake was computed using the results from the HEC-RAS model. Based on the HEC-RAS results and literature values for bed roughness, the bed shear stress in McDowell Lake was estimated to be approximately 50 dynes per square centimeter (dynes/cm^2) for the 2.8 ft/sec flow. The maximum depth of scour for this shear stress was estimated using the figure below, which is based on numerous erosion studies for cohesive sediments in river systems (after Ziegler, 1999):

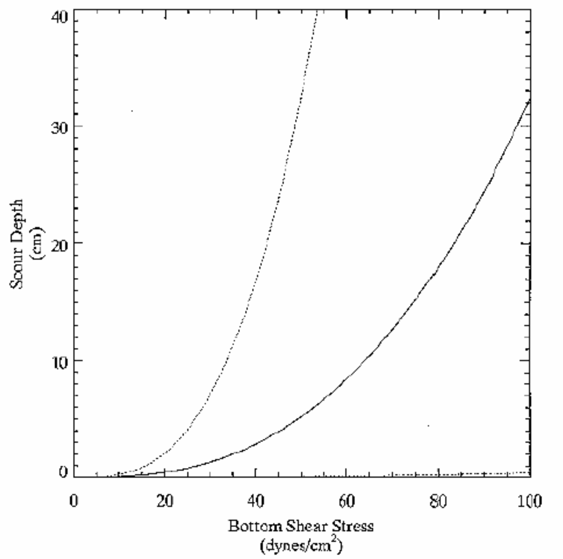

Figure A-8 - Estimated scour depth as a function of bottom shear stress for average (solid line) and 95% confidence interval limit (dashed lines) erosion parameters (Ziegler, 1999, p.9)

Based on the estimated bed shear stress, the maximum scour depth is estimated to be between 5 cm and 40 cm (1.3 ft) for the steady-state HEC-RAS results. This is a very conservative estimate which does not account for effects of bed armoring, sediment deposition, and sediment compaction with depth which would reduce the net effects of sediment scour.

This result indicates a potential for scour of overburden sediments, although it is unlikely that sufficient erosion would occur to remobilize sediments above the cleanup criterion during Stage 2 remediation. Final design modeling will include a comparison of predicted scour depths with sediment core data to better assess remobilization potential.

3.4 Stage 3

During the Stage 3 remediation, the upstream flow from the West Branch DuPage River will be allowed to flow to the northern and southern channel. In addition, the sheetpile will be configured to allow for the flow from Ferry Creek to flow downstream west of the island. A model was not developed for this remedial scenario as one-dimensional models (such as HEC-RAS or FEQ) do not adequately account for the effects of potentially opposing flows and multiple flow channels around an island. With the constriction of the northern channel into the sheetpile and the bounded channel around the island, Ferry Creek flows may raise water levels and slow northern channel flows. Determination of the resulting flow in the northern channel cannot be reliably determined by HEC-RAS, but the results can be inferred from the previous model applications. In Stage 3, velocities will not be significantly different from the base case in either the northern channel or the southern channel. Furthermore, in Stage 3, the flow will be diverted through areas that have already been remediated, so remobilization of sediments containing radium above the clean up standard is not a concern.

The increase in the flood elevation is also not expected to be as significant as either Stage 1 or Stage 2. The majority the Ferry Creek and River flows will be conveyed through the main channel of McDowell Lake. The main channel conveys a large portion of the flow during the base case. This would minimize any increase in flood elevation through the northern and southern channels and upstream of the island.

4.0 Summary of Results

It must be noted that the steady state application of HEC-RAS to simulate water diversion during remediation in Reach 8 provides only an approximate representation of potential effects on flooding and flow velocities, for several reasons. These include limited survey data, the use of steady-state peak flow results to simulate a very dynamic and transient flood event, and approximate determination of 2-year return flows in Ferry Creek and the West Branch DuPage River that are the basis for the analysis. Additionally, the one-dimensional modeling approach of both HEC-RAS and FEQ is limited in its ability to address flow effects around the sheetpile structures in some areas. However, although the modeling approach is approximate, it is suitable and reasonable for use in conceptual design of a remediation approach. The water routing and potential flooding effects will be simulated and addressed in more detail during final design activities, including the application of a two-dimensional model.

4.1 Stage 1

Water surface elevations and velocity increases above the base case due to diversion of the River through the southern channel are fairly low. Upstream water surface elevations are increased by about 6 inches for the 2-year event relative to the base case and flow velocities are increased about 1 ft/s over the base case in the southern channel. Some remobilization of sediments in the southern channel may occur, as would be expected during any increased flow event.

4.2 Stage 2

In terms of elevating upstream flooding potential or bed scour potential, the controlling or maximum case appears to be Stage 2, where the upstream River flow is routed through the northern channel around the island and combines with Ferry Creek to McDowell Lake. An assessment of bed shear stress and a highly conservative estimate of bed scour potential indicate that up to 1.3 ft of sediment could be remobilized in McDowell Lake. This estimate does not account for sediment armoring or deposition that limits scour depths. Even so, these results suggest that sediments above the cleanup criterion would be unlikely to erode during remediation. Water surface elevations during flood conditions are expected to increase up to 1.3 ft upstream of the island in the River.

4.3 Stage 3

In Stage 3, water surface elevations in the southern channel and the northern channel would be only slightly affected. Flow velocities in the northern channel would be slightly above the base case. The increase in velocities and scour potential in the northern channel and McDowell Lake is not expected to be as high as Stage 2 remedial activities. However, since sediments above the cleanup criterion will be excavated during Stages 1 and 2, remobilization of these sediments in these areas would not occur.

5.0 Considerations for Final Design

The Reach 8 modeling analysis presented here provides a reasonable approximation of effects of water diversion on flood water surface elevations and flow velocities to support conceptual design. Several points of uncertainty should be acknowledged, however, that merit further consideration in final design. These include: 1) River bottom elevations at important locations that will control flow dynamics during each stage (to date available survey information is fairly limited); 2) the timing and magnitude of the Ferry Creek hydrograph relative to the West Branch DuPage River hydrograph during flood events; 3) localized flow dynamics at channel constrictions that can be better represented and water surfaces and velocities better determined with a two-dimensional model; and 4) a lack of geophysical data on the sediments that would allow a quantitative assessment of bed erosion potential if a large flow did occur during remediation.

Additional modeling steps that should be conducted in final design for Reach 8 include extension of the model upstream to at least Diehl Road, inclusion of additional cross-section survey data at the channel mouths and several other key locations, more accurate representation of actual depths of sediment removal in each area, and simulation of flows higher than the 2-year flow to verify that flooding impacts would be acceptable at higher flows. The current analysis assumed that designing to allow overtopping at high flood flows would result in minimal increased flooding potential beyond what would occur for the 2-year flow.

6.0 References

Blasland, Bouck & Lee, Inc. (BBL) October 2002. *Conceptual Design Report: Kress Creek/West Branch DuPage River Site.*

Ziegler, C.K. 1999. *Sediment Stability at Contaminated Sediment Sites.* Sediment Management Work Group. Contaminated Sediment Management Technical Papers & Web Site. www.smwg.org. Fall 1999.

Figures

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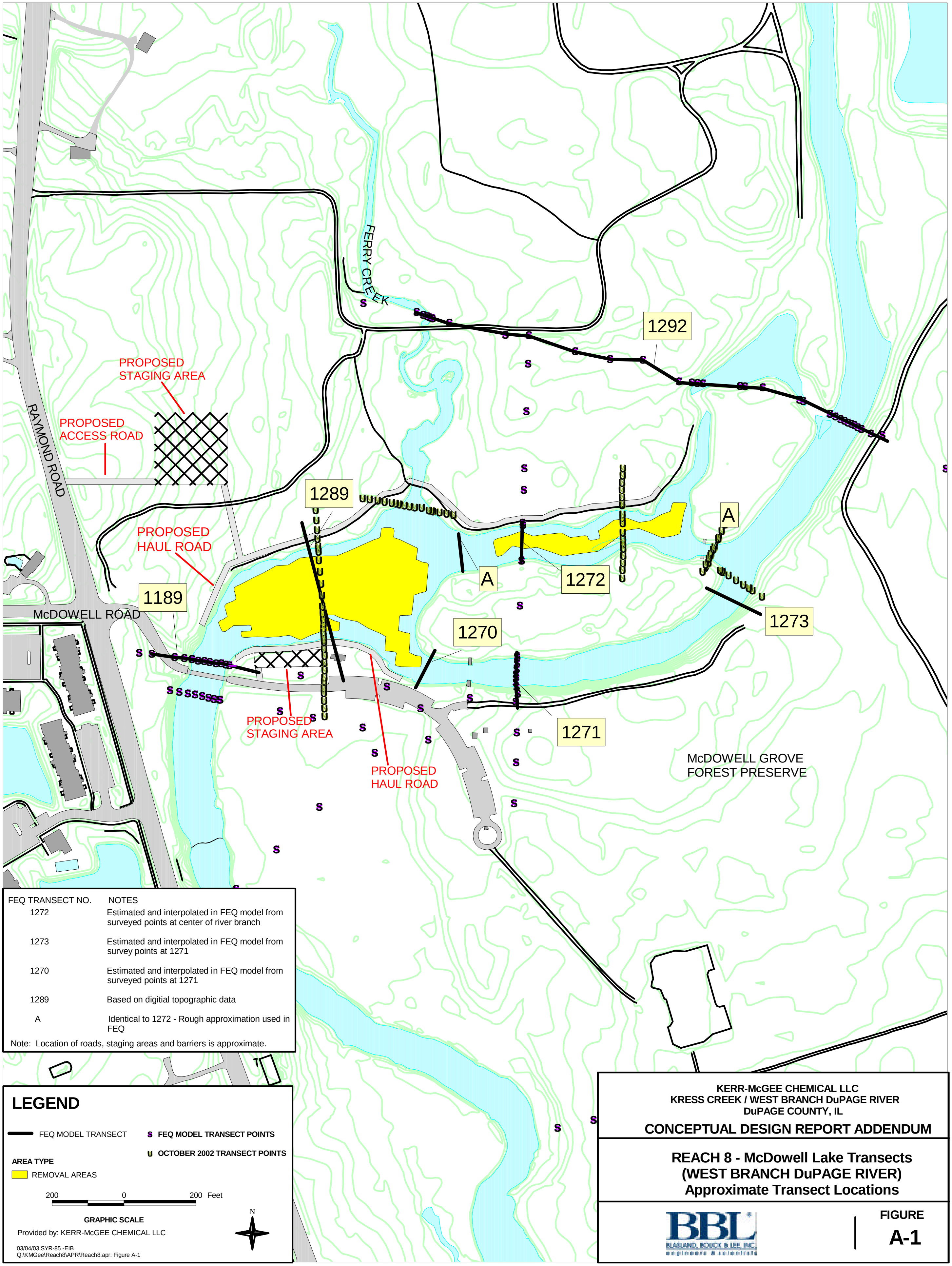

FERRY CREEK
1292
PROPOSED
STAGING AREA
PROPOSED
ACCESS ROAD
RAYMOND ROAD
1289
PROPOSED
HAUL ROAD
A
1272
A
1273
1189
McDOWELL ROAD
1270
1271
PROPOSED
STAGING AREA
PROPOSED
HAUL ROAD
McDOWELL GROVE
FOREST PRESERVE
FEQ TRANSECT NO. NOTES
1272 Estimated and interpolated in FEQ model from surveyed points at center of river branch
1273 Estimated and interpolated in FEQ model from survey points at 1271
1270 Estimated and interpolated in FEQ model from surveyed points at 1271
1289 Based on digitial topographic data
A Identical to 1272 - Rough approximation used in FEQ
Note: Location of roads, staging areas and barriers is approximate.
LEGEND
FEQ MODEL TRANSECT
S FEQ MODEL TRANSECT POINTS
U OCTOBER 2002 TRANSECT POINTS
AREA TYPE
REMOVAL AREAS
200 0 200 Feet
GRAPHIC SCALE
Provided by: KERR-McGEE CHEMICAL LLC
03/04/03 SYR-85 -EIB
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KERR-McGEE CHEMICAL LLC
KRESS CREEK / WEST BRANCH DuPAGE RIVER
DuPAGE COUNTY, IL
CONCEPTUAL DESIGN REPORT ADDENDUM
REACH 8 - McDowell Lake Transects
(WEST BRANCH DuPAGE RIVER)
Approximate Transect Locations
BBL
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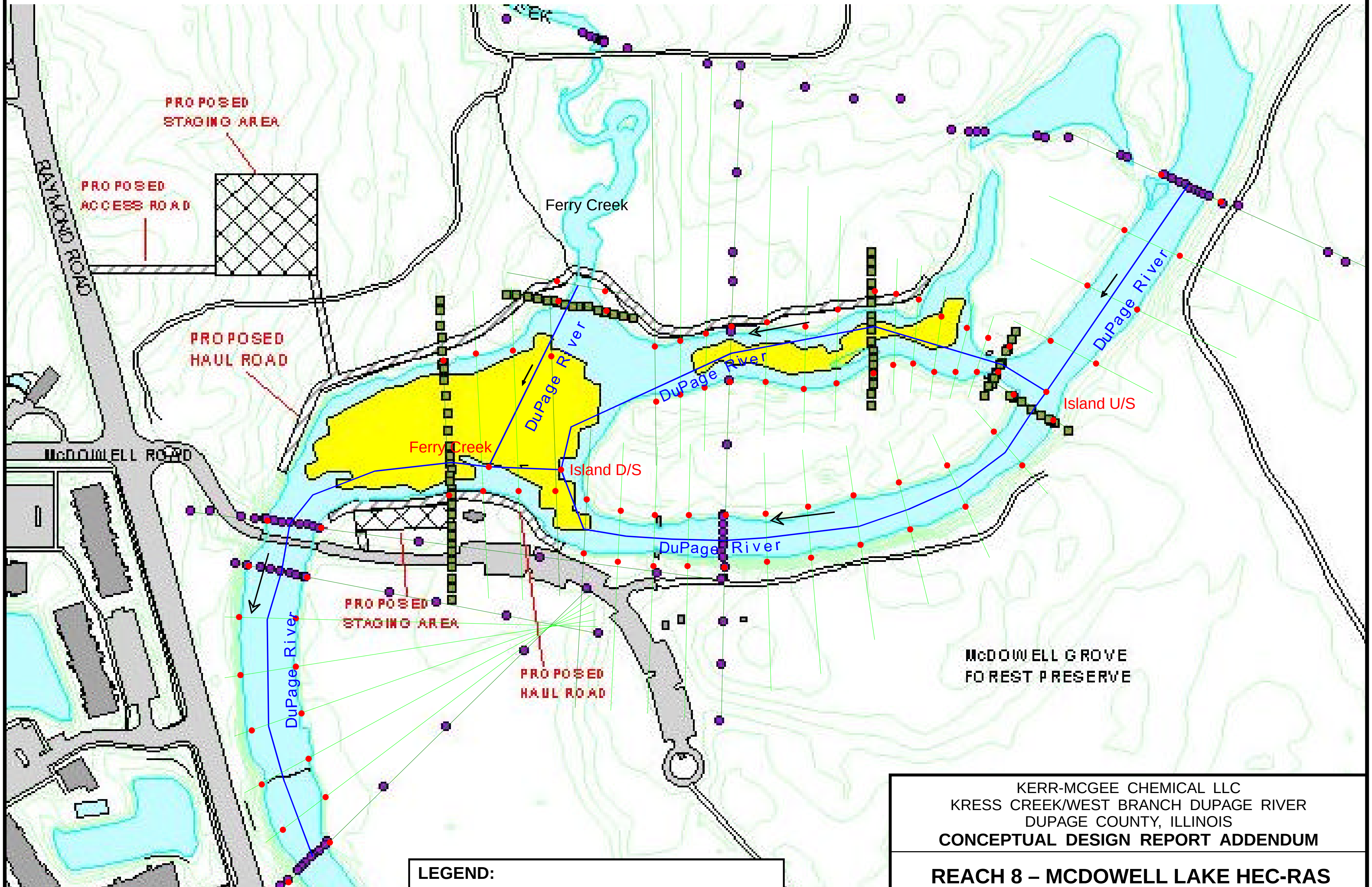
FIGURE
A-1



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KERR-MCGEE CHEMICAL LLC
KRESS CREEK/WEST BRANCH DUPAGE RIVER
DUPAGE COUNTY, ILLINOIS
CONCEPTUAL DESIGN REPORT ADDENDUM

REACH 8 – MCDOWELL LAKE HEC-RAS MODEL CONFIGURATION

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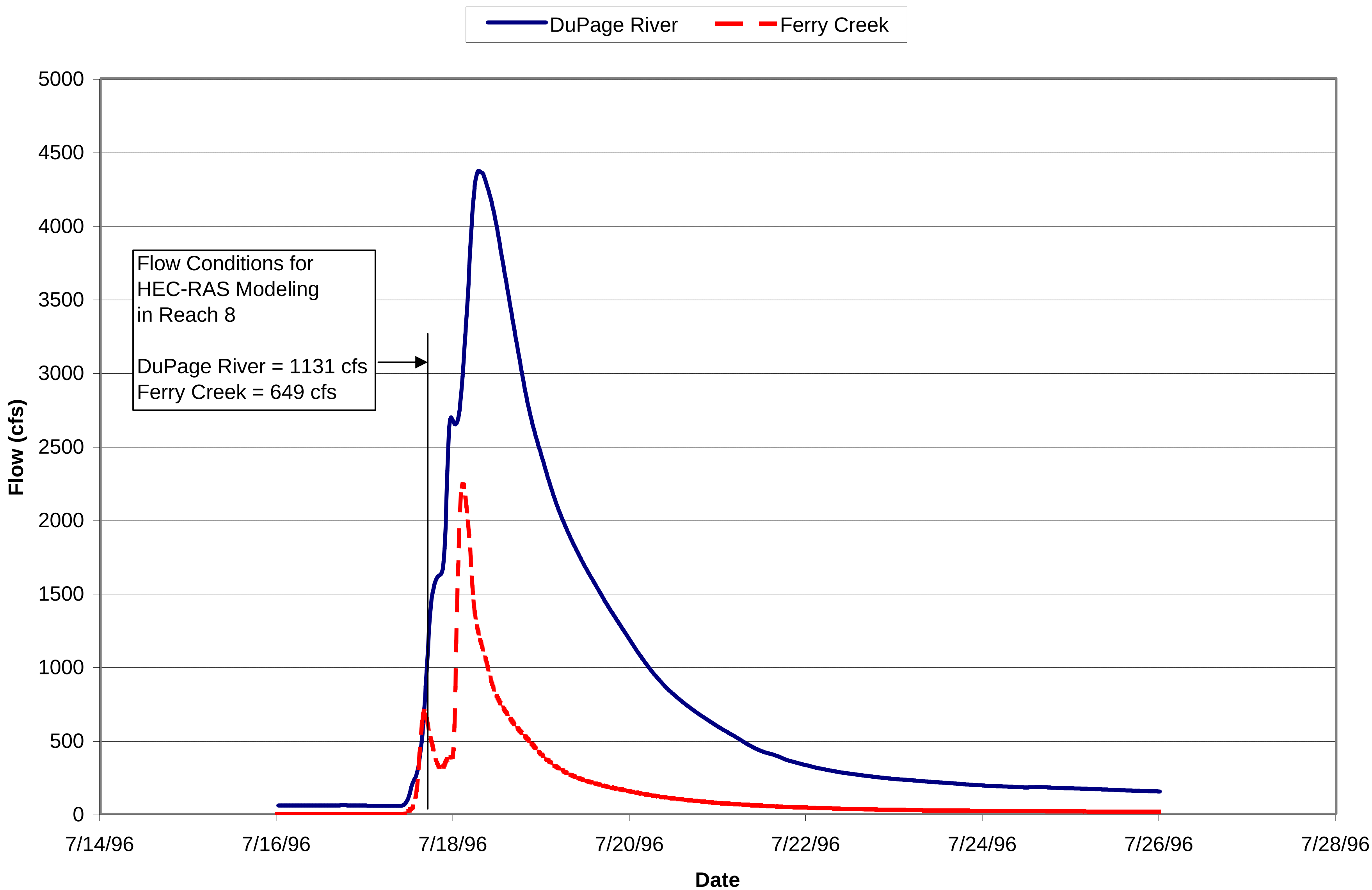
FIGURE A-2

Figure A-3
DuPage River and Ferry Creek Flow at Reach 8 During the July 1996 Event



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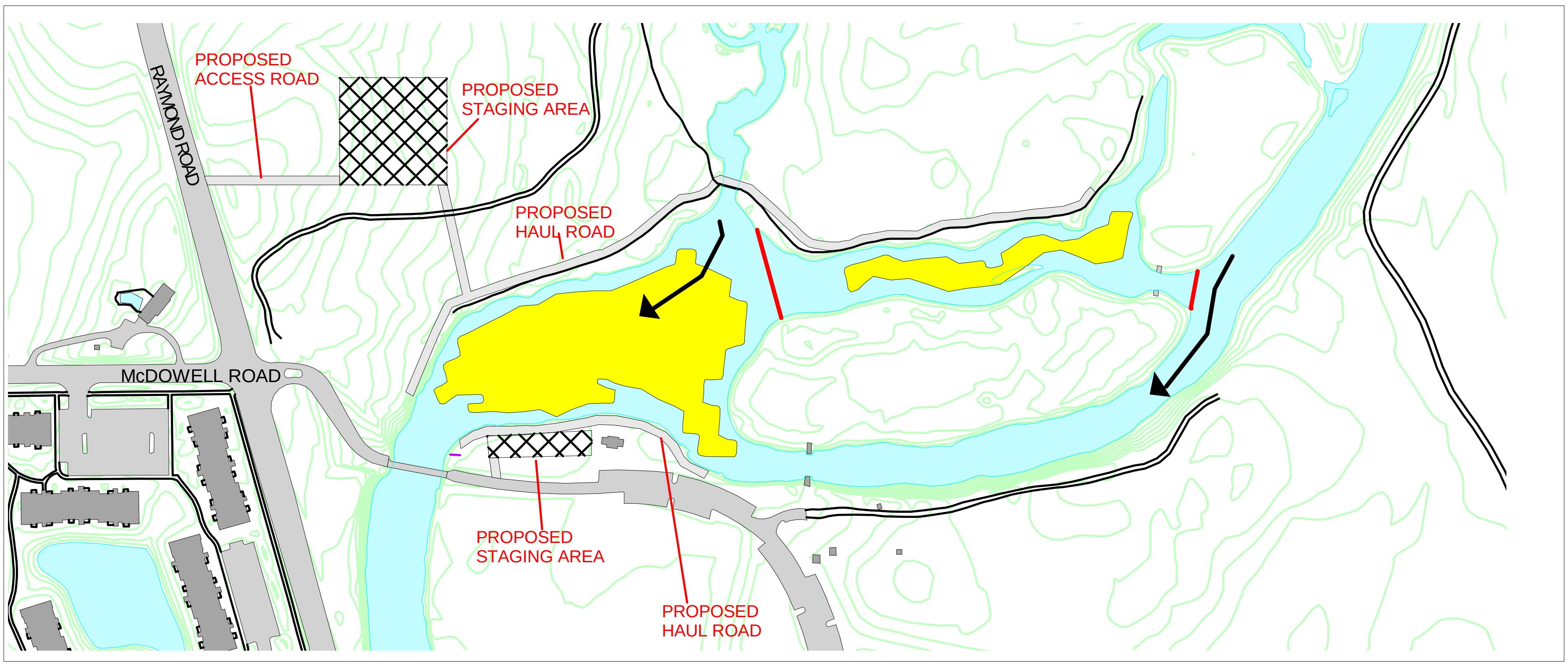
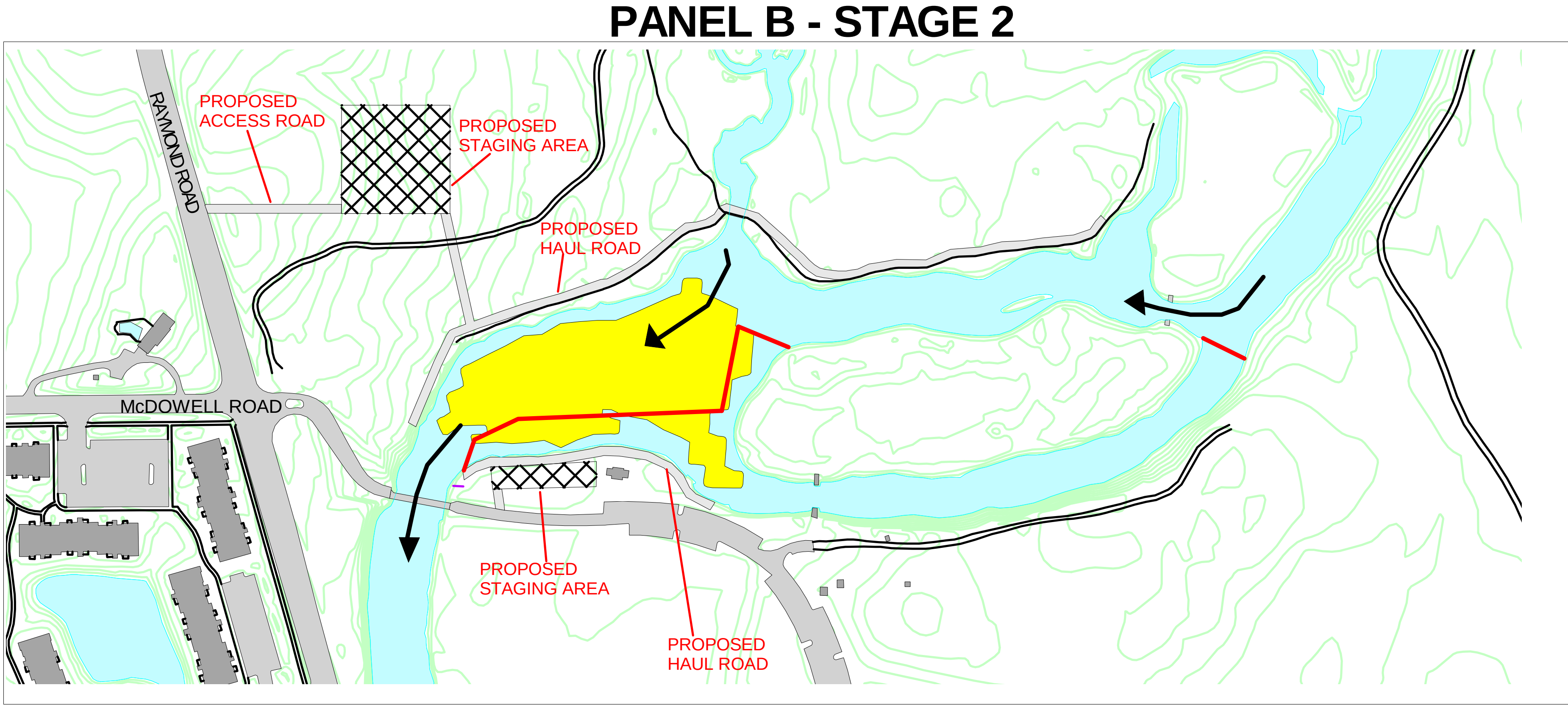
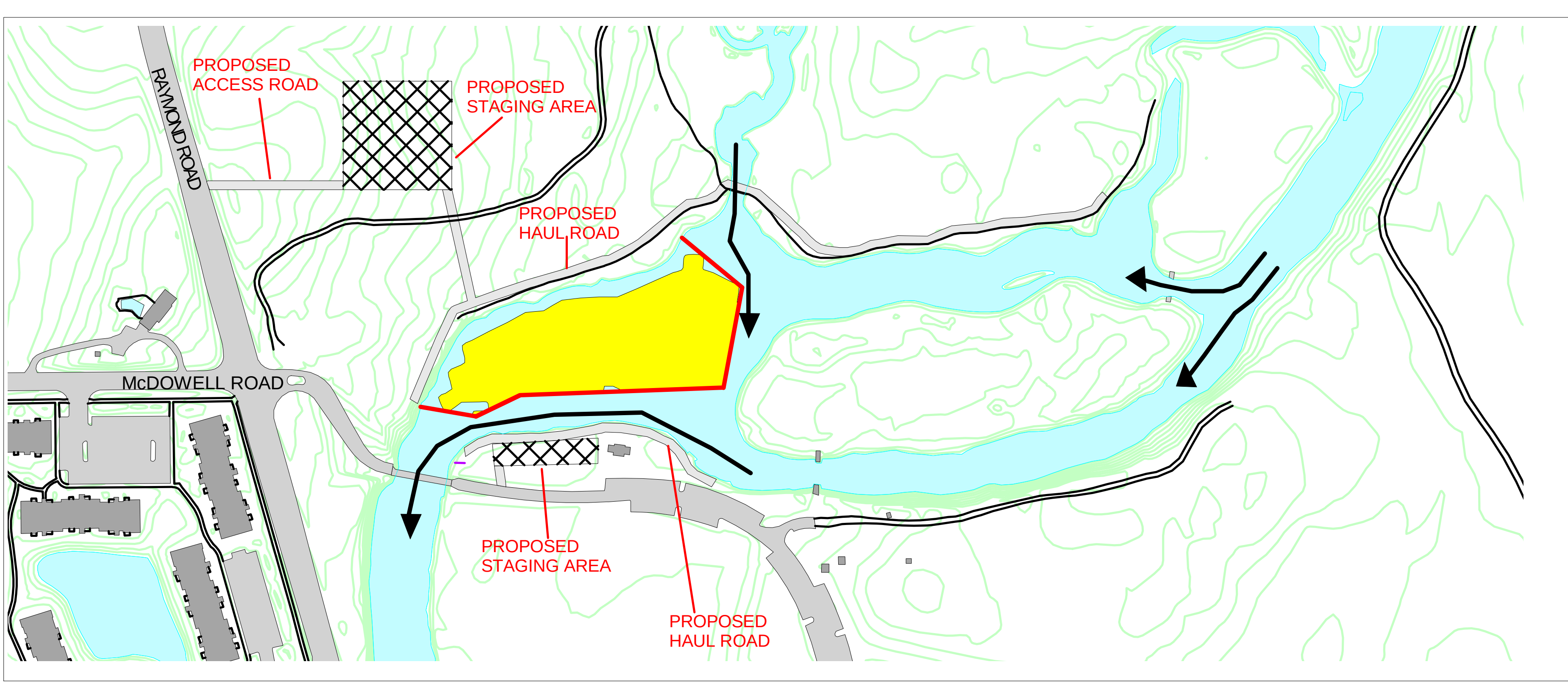
PANEL A - STAGE 1



PANEL B - STAGE 2



PANEL C - STAGE 3



LEGEND

DIRECTON OF FLOW

AREA TYPE

REMOVAL AREAS

BARRIER TYPE

SHEETPILE

300 0 300 Feet

GRAPHIC SCALE

N

Provided by: KERR-McGEE CHEMICAL LLC

03/04/03 SYR-85 -EIB
Q:\KMGee\Reach8\APR\Reach8.apr: Figure A-4

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KRESS CREEK / WEST BRANCH DuPAGE RIVER
DuPAGE COUNTY, IL
CONCEPTUAL DESIGN REPORT ADDENDUM

REACH 8 - McDowell Lake
(WEST BRANCH DuPAGE RIVER)
Sheetpile Placement and Water Routing

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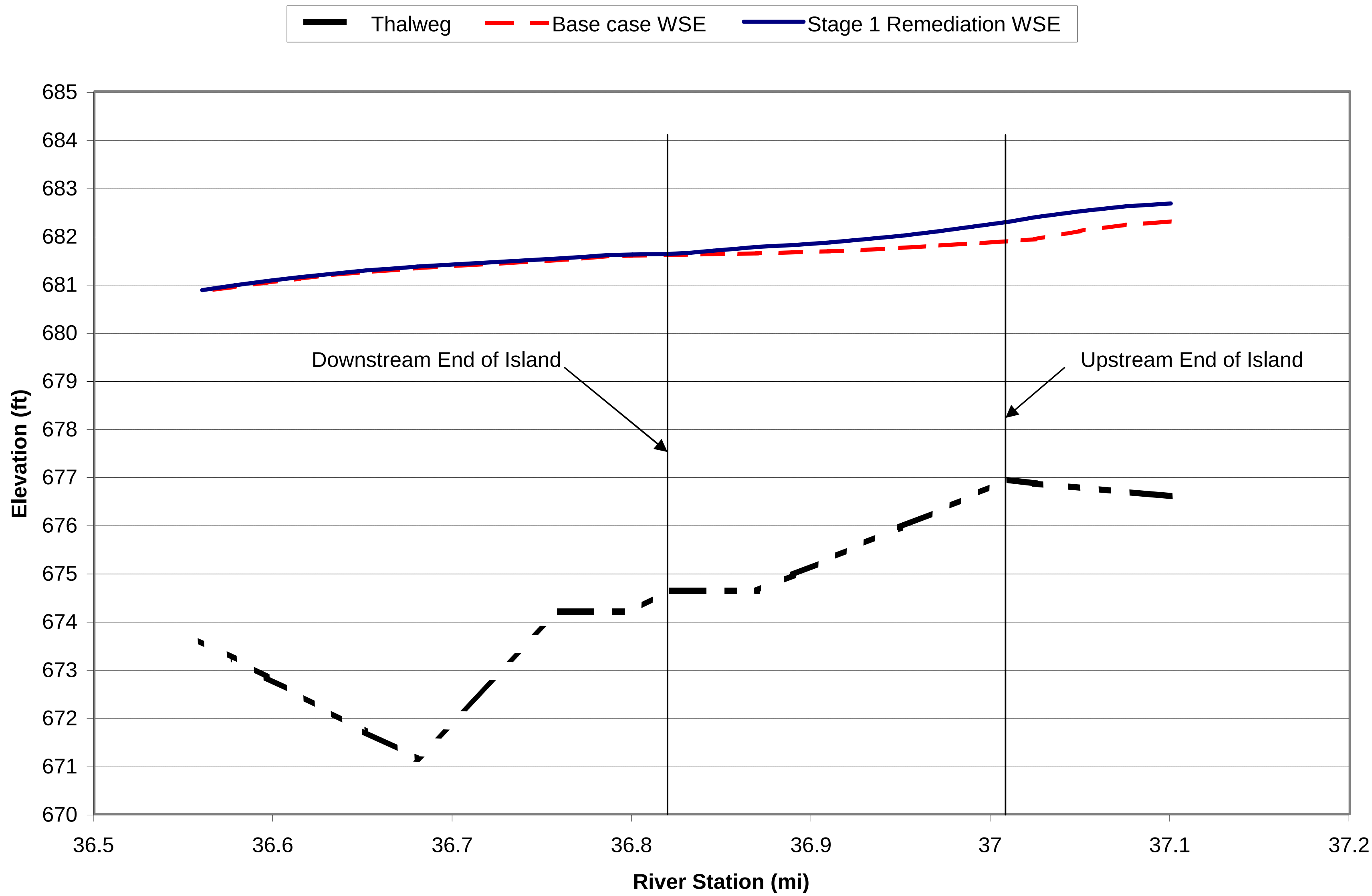
FIGURE

A-4

Figure A-5
Predicted Change in Water Surface Elevation (WSE) for Reach 8
for Stage 1 Remediation 2-year Flood Event



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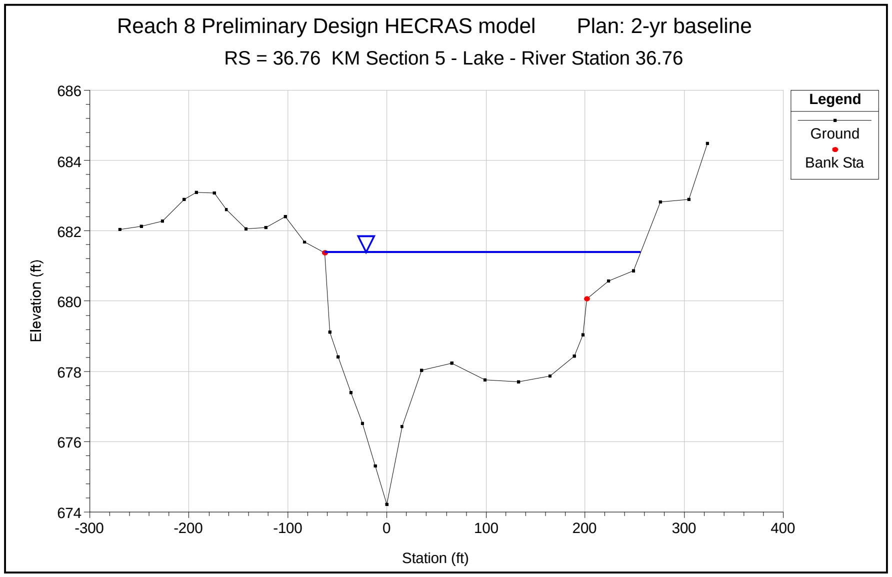
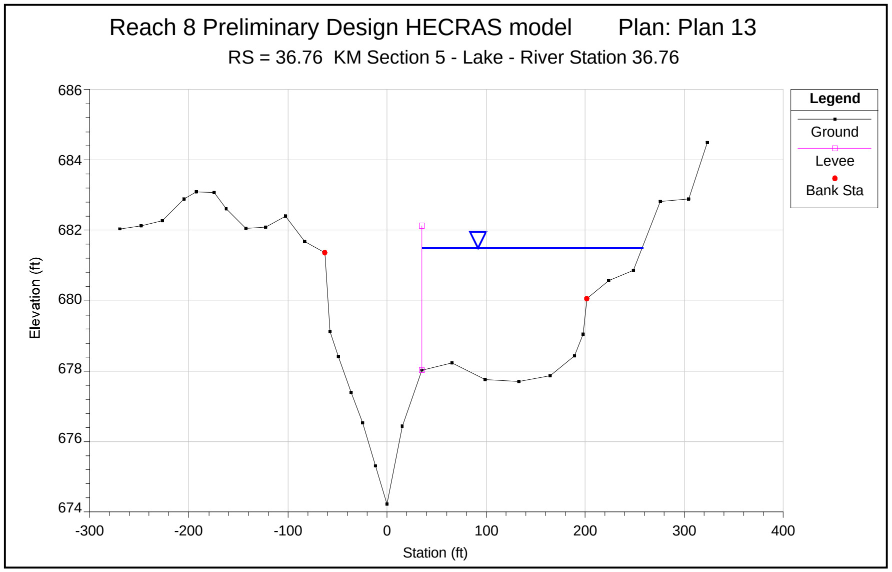
A. 2-year Flood Event Base Case



B. Sheetpile Placement for Stage 2 Remediation



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DUPAGE COUNTY, ILLINOIS

CONCEPTUAL DESIGN REPORT ADDENDUM

REACH 8 - HEC-RAS REPRESENTATION OF CROSS-SECTIONS IN MCDOWELL LAKE AT RM 37.76 FOR EXISTING AND SHEETPILE PLACEMENT DURING STAGE 2 REMEDIATION

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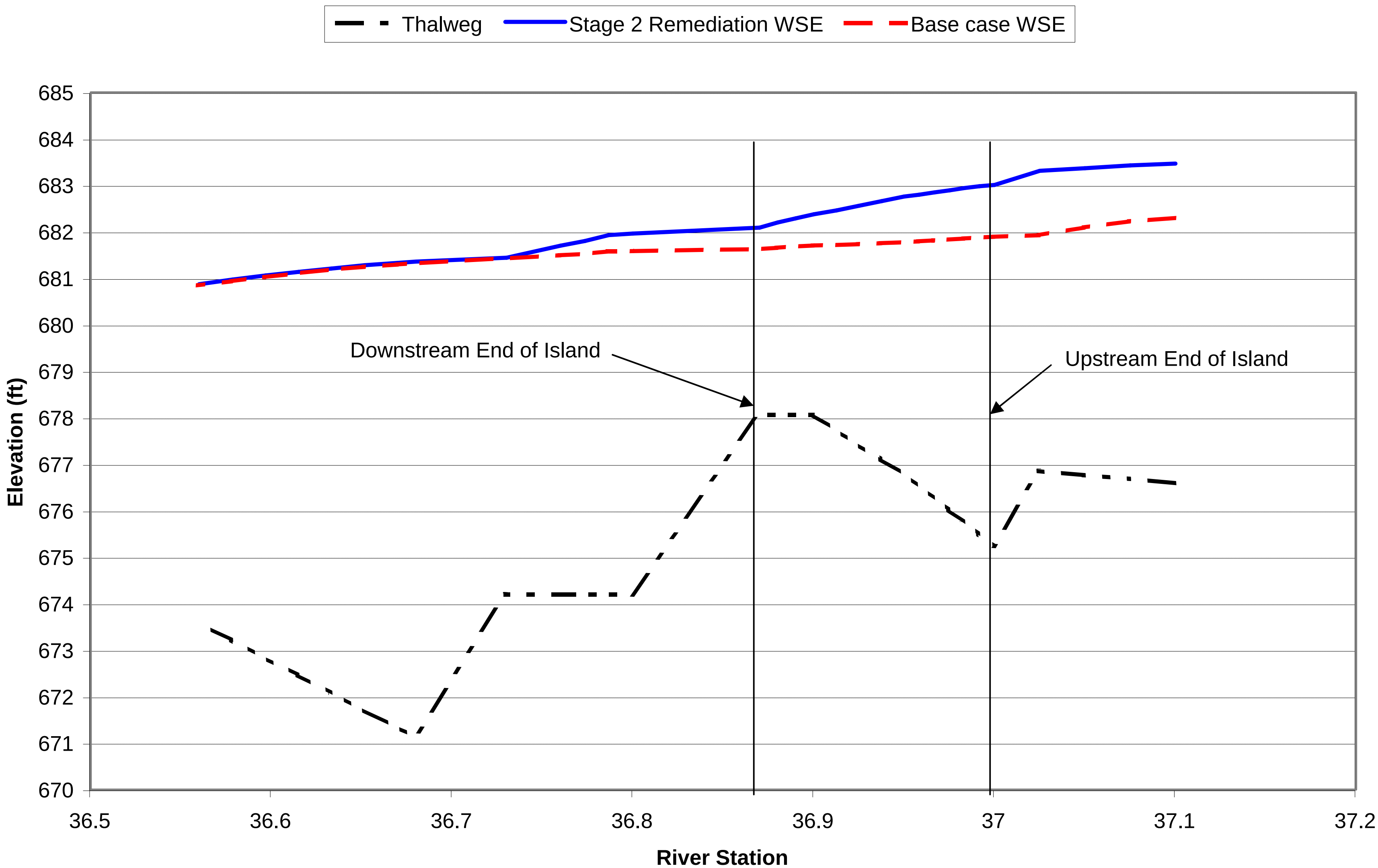
FIGURE A-6

12/05/02 SYR-D54-DJH
71004008/71004G01.cdr

Figure A-7
Predicated Change in Water Surface Elevation (WSE) for Reach 8 in McDowell Lake and North Channel for Stage 2 Remediation 2-year Flood Event



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